WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005MD78B

Title: Theoretical and experimental evaluation of acetate thresholds as a monitoring tool for in situ bioremediation

Project Type: Research

Focus Categories: Toxic Substances, Groundwater, Methods

Keywords: groundwater, in situ bioremediation, petroleum hydrocarbons, monitoring, redox indicator

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: $29,990

Non-Federal Matching Funds: $60,068

Congressional District: 5th District of Maryland

Principal Investigators:
Jennifer G. Becker

Hubert J. Montas
University of Maryland

Eric A. Seagren
University of Maryland

Abstract

In situ bioremediation approaches offer great potential for cost-effective clean-up of environmental contamination. However, demonstrating the success of in situ bioremediation can be challenging due to the heterogeneous, dynamic, and inaccessible nature of the subsurface. The consumption of electron acceptors during bioremediation of hydrocarbons and other contaminants can result in shifts in the predominant terminal electron-accepting processes (TEAPs), which may be useful for monitoring. Because traditional assessment tools have disadvantages, an accurate indicator of TEAPs is still needed. Using an integrated experimental and modeling approach, this study will systematically test the hypothesis that characteristic ranges of acetate thresholds may exist for different TEAPs and, therefore, acetate concentrations may be useful for

monitoring bioremediation. Acetate thresholds established by pure microbial cultures that utilize acetate as an electron donor and different TEAPs will be measured experimentally using batch laboratory systems. The importance of kinetic and thermodynamic factors in controlling acetate thresholds will be evaluated using a mechanistic mathematical model. Model parameters will be obtained by fitting the model to the experimental data. The usefulness of acetate thresholds as indicators of bioremediation will be evaluated by measuring acetate concentrations in contaminated sediments and comparing measured values to model-predicted concentrations.